Assessment of Ground Water Quality And Its Impact On Human Health in Dhule City of Maharashtra, India.

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Abstract :
Ground water quality and its impact on human health in Dhule city of Maharashtra, INDIA was assessed. Ground water samples from different locations of Dhule city were collected and were analyzed using standard methods for various physico-chemical parameters such as pH , Electrical Conductivity , Total Hardness, Total Dissolved Solids, Calcium , Magnesium, Chlorides , Sulphates and Dissolved Oxygen. The observed values of these parameters were compared with the standards given by WHO, ISI and ICMR. It was found from the present study that there is variation in many physico-chemical parameters. Some of the samples were found within the permissible limits of the given standards while some samples are beyond the acceptable values of the standards, indicating that for such samples there is poor potability might be due to contaminations from sewage, hospital waste and other water soluble pollutants . Hence there need for proper conservation and management of ground water recourses, conducting campaigns on health awareness and importance water purification among the peoples in such study area before utilizing such poor quality water for drinking purpose.
Key Words: Ground water, Physico-chemical parameters, Human health.

Introduction

Water is the elixir for the life. The quality of water is of vital concern for mankind because it sustains life. It is matter of history that pollution of drinking water caused water born disease, epidemics and is still looming large of the horizon of developing countries like India. Adequate Supply of Potable safe water is absolutely essential and is the basic need for all human being on the earth. Due to rapid industrialization and subsequent contamination of surface and ground water sources, water conservation and water quality management has now a days assumed very complex shape. Attention on contamination and its management has become a need of the hour, because of it's for reaching impact on human health. (Singh K.P. *et.al.*;, 2005) and (Palanisami P. N. *et.al.;* 2007)

The major source of contamination of underground water is the industrial waste, hospital waste and domestic discharge etc. In order to ensure the right quality of water for this purpose it is extremely important to monitor underground water with all aspects into consideration. However with increase in demand due to population pressure this source is now a day over exploited in many parts on the earth. (Manzoor S. *et.al.;* 2006)

Study Area :

The area under study is the most rural district of Maharashtra. The district of Dhule, formerly known as West Khandesh and known after district head quarters since 1960. It is the western most of the district of North border of Maharashtra state. Sampling locations were selected on the basis of the detailed survey of the study area and discussions with local experts from water department of Municipal Corporation The sampling was carried out in the study area, from eight open wells and seven bore wells in the rainy and summer seasons from June 2010 to September 2011.The details regarding the locations is given in table No.1.

Sample No.	Name of Location	Sample No.	Name of Location
S-1	Shivaji Nagar, Nagaon Bari	S-9	Pratap mill area
S-2	Swami Narayan Mandir Area	S-10	Hamal Mapadi Colony
S-3	Sarswati Colony	S-11	Phule Colony
S-4	Walwadi shiwar	S-12	Dongare Maharaj Nagar
S-5	Ramnagar	S-13	Jankinagar Wadibhokar Road
S-6	Sai Mangal Karyalaya	S-14	Paras Manal Karyalaya
S-7	Professor Colony	S-15	Anand Nagar
S-8	Vidyawardhini College Sakri road		

Table 1: Details of Sampling Location

Experimental :

The samples collected were subjected to various physico-chemical analysis in order to assess their quality and potability. Water samples were analyzed using standard methods. (APHA, 1992) and (Kotaiah B. *et.al.;)*

Physico-chemical parameters such as Temperature, Electrical conductivity, Total Dissolved Solids, Dissolved Oxygen, Total Hardness, Total Alkalinity, Calcium, Magnesium, Sodium, Potassium and chloride were determined using standard methods. (Manivasakam N, 2005)

Results & Discussion:

The Values obtained for various physico-chemical parameters after analytical determination are given in Table 3: The values were compared with the standard values given by WHO: 2003, (WHO, 1971) and ISI (10500-1993) as given in Table 2.

Sr.No.	Characteristics	WHO (2003)	ISI (10500-1993)
1.	pH	6.5-9.5	6.5-8.5
2.	TDS	500.00	500.00
3.	Electrical Conductivity	1400.00	--
4.	Total Hardness	500.00	300.00
5.	Chloride	250.00	250.00
6.	Calcium	200.00	75.00
7.	Magnesium	30-150	30.00
8.	Dissolved Oxygen	5.00	--
9.	Alkalinity	200.00	200.00
10.	Sodium	250.00	--
11.	Potassium	45.00	--

Table 2: Standard for drinking water

(All values in mg/lit except pH and EC)

The data of analysis of various parameters for the three seasons are given in Table 3, Table 4 and Table 5.

Sample No.	Type	Temp. °C	pH	TDS mg/L	EC µ mho/cm	TH	Cl mg/L	Ca mg/L	Mg mg/L	DO mg/L	Alkalinity mg/L	Na	K
S1	OW	27.4	7.5	541	1150	178	99.4	40.08	28.68	6.3	200	74	2.3
S2	BW	27.6	7.5	806	1236	268	184.6	46.09	44.24	7.2	256	68	1.6
S3	BW	27.8	7.6	824	1280	232	134.9	58.12	35	5.6	308	82	4.1
S4	OW	28.2	7.4	570	1028	196	145.55	44.08	26.74	5.9	452	79	2.1
S5	BW	27.5	7.7	169	2100	156	241.4	10.02	26.25	6.1	572	91	6.4
S6	OW	27.2	7.8	783	1100	168	156.2	54.11	33.06	5.8	376	48	2.5
S7	BW	27.3	7.1	716	1518	204	173.95	68.13	28.19	4.3	152	94	3.2
S8	BW	27.5	7.5	667	1189	212	88.75	92.18	36.46	6.5	192	86	4.5
S9	BW	27.8	7.3	855	1808	332	181.05	132.26	64.17	5.5	180	63	2.6
S10	OW	27.1	7.5	502	3641	542	702.9	110.22	99.67	3.7	320	57	1.7
S11	OW	27.3	7.7	923	1625	204	166.85	50.1	35	5.6	356	42	6.1
S12	BW	27.5	7.6	749	2840	294	365.65	62.12	52.02	6.2	368	71	2.9
S13	OW	28.3	7.6	647	1258	164	110.05	64.13	49.59	6.1	268	54	4.3
S14	OW	28.1	7.2	588	1148	234	230.75	56.11	31.65	6.7	309	72	4.2
S15	OW	27.9	6.9	613	1209	222	170.4	82.16	36.04	5.8	452	66	1.8

Table 3 : The data of analysis of ground water samples in first rainy season from June 2010 to Sept 2010

Sample No.	Type	Temp. °C	pH	TDS mg/L	EC µ mho/cm	TH	Cl mg/L	Ca mg/L	Mg mg/L	DO mg/L	Alkalinity mg/L	Na	K
S1	OW	31.2	8.5	651	1010	304	124.25	52.1	33.55	5.1	316	88	4.6
S2	BW	30.7	8.4	945	1323	354	248.5	70.14	55.43	6.5	368	85	3.9
S3	BW	30.3	8.5	892	1420	404	159.75	82.16	80.71	4.3	488	76	5.3
S4	OW	31.5	8.2	729	1200	386	195.25	62.12	35.01	4.8	432	94	4.7
S5	BW	30.6	8.6	348	2260	262	284	36.01	30.14	5.2	624	93	8.1
S6	OW	31.1	8.1	847	1390	288	213	76.15	40.84	4.4	452	83	5.4
S7	BW	30.1	7.6	856	1644	414	266.25	84.16	35.98	3.8	376	89	7.2
S8	BW	30.5	8	774	1236	362	124.25	112.22	45.21	5.8	232	92	6.3
S9	BW	30.2	7.8	912	1722	516	230.75	148.3	75.84	4.3	424	74	3.5
S10	OW	30.5	8.1	832	2700	808	763.25	184.36	119.61	3.2	616	82	4.2
S11	OW	30.1	8.3	1029	1730	414	213	64.12	42.3	4.5	568	67	7.9
S12	BW	29.8	7.9	1060	2910	512	372.75	86.17	67.1	5.5	620	87	5.7
S13	OW	30.3	8.4	762	1270	324	142	80.16	62.23	5.4	408	81	7.4
S14	OW	30.8	7.9	647	1263	342	266.25	92.18	43.27	5.5	424	89	6.5
S15	OW	31.3	8.2	718	1339	312	230.75	104.2	51.53	5.3	548	85	5.1

Table 4 : The data of analysis of ground water samples in Summer Season from Feb 2011 to May 2011

Sample No.	Type	Temp. °C	pH	TDS mg/L	EC µ mho/cm	TH	Cl mg/L	Ca mg/L	Mg mg/L	DO mg/L	Alkalinity mg/L	Na	K
S1	OW	27.9	7.8	518	1040	166	106.5	48.09	35	6.5	216	80	2.9
S2	BW	28.2	7.2	759	1370	282	177.5	36.07	50.56	6.8	240	77	2.1
S3	BW	28.1	7.8	846	1357	214	124.25	74.15	27.71	6.1	284	68	3.5
S4	OW	27.6	8.1	537	1109	218	124.25	56.11	33.55	5.4	468	87	2.8
S5	BW	28.2	8.3	213	2448	172	213	22.04	31.12	6.3	544	84	5.9
S6	OW	26.5	8	803	1252	146	142	46.09	25.76	5.5	348	62	2.9
S7	BW	27.1	6.8	735	1529	226	195.25	54.11	40.84	4.6	168	82	4.2
S8	BW	26.9	7.9	644	1172	204	106.5	84.17	44.24	6.9	208	67	3.8
S9	BW	27.4	7.4	826	1823	312	159.75	118.24	55.43	5.2	164	46	1.7
S10	OW	26.6	7.2	529	3270	568	674.5	122.24	81.68	3.9	336	62	2.3
S11	OW	27.8	8.1	876	1598	232	177.5	62.12	46.19	5.8	376	54	6.5
S12	BW	28	7.8	763	2815	308	390.5	46.09	38.41	6.6	392	78	3.2
S13	OW	28.5	7.9	668	1243	186	124.25	78.16	60.78	6.4	252	65	5.1
S14	OW	27.7	7.4	605	1165	220	248.5	64.13	42.3	7.2	284	67	3.6
S15	OW	28.1	7.2	642	1224	234	142	68.14	47.16	6.2	464	58	2.4

Table 5 : The data of analysis of ground water samples in Second Rainy Season from Jun 2011 to Sept 2011

Similarly the variations in Total Dissolved Solids (TDS) are shown in Table 6. Total Dissolved Solids (TDS) of the samples analyzed varies from 169 mg/L to 1060 mg / Lit. All these samples except sample S-5 is found to be within the permissible limit for all the three seasons study and remaining samples were higher than the permissible limit.

Sr. No.	Type of Water	Sampling Station	Seasons		
			First Rainy Season	Summer Season	Second Rainy Season
1.	Open Well	S1	541	651	518
2.	Bore Well	S2	806	945	759
3.	Bore Well	S3	824	892	846
4.	Open Well	S4	570	729	537
5.	Bore Well	S5	**169**	**348**	**213**
6.	Open Well	S6	783	847	803
7.	Bore Well	S7	716	856	735
8.	Bore Well	S8	667	774	644

9.	Bore Well	S9	855	912	826
10.	Open Well	S10	502	832	529
11.	Open Well	S11	**923**	1029	**876**
12.	Bore Well	S12	749	**1060**	763
13.	Open Well	S13	647	762	668
14.	Open Well	S14	588	647	605
15.	Open Well	S15	613	718	642
Minimum			169	348	213
Maximum			923	1060	876
Average			663.53	800.13	664.27

Table 6: Seasonal variation in Total Dissolved Solids (mg/L) of open-well and bore-well water of Firs Rainy Season (June 2010 to Sept. 2010), Summer Season (February 2011 to May 2011) and Second Rain Season (June 2011 to Sept. 2011).

The higher value of TDS could be due to low water levels within aquifers and sediment effect[8].Higher TDS value recorded in summer season was 1060 mg / Lit, The high TDS values may be due to ground water pollution, usually when waste water from residence, Hospital smaller dyeing units were discharged into pits and ponds, enabling the waste percolates down to the water table. The trend of TDS variations is shown in figure 1, 2 and3. (Dotted line indicates permissible limits).The consumption of water having high dissolved solids and hardness may cause harmful effect like kidney stone formation and other related diseases. It may taste bitter, salty or metallic and may have unpleasant odors. High TDS water is less thirst quenching. High TDS interferes with the taste of foods and beverages and makes them less desirable to consume. Some of the individual mineral salts that make up TDS pose a variety of health hazards. The most problematic are nitrates, sodium , sulfates , barium, cadmium, copper and fluoride. Most of them eliminated through excretory channels but some of them will stay in the body, causing stiffness in the joints, hardening of the arteries, kidney stones, gall stones and blockage of arteries, microscopic capillaries and other passages in which liquids flow through our entire body.

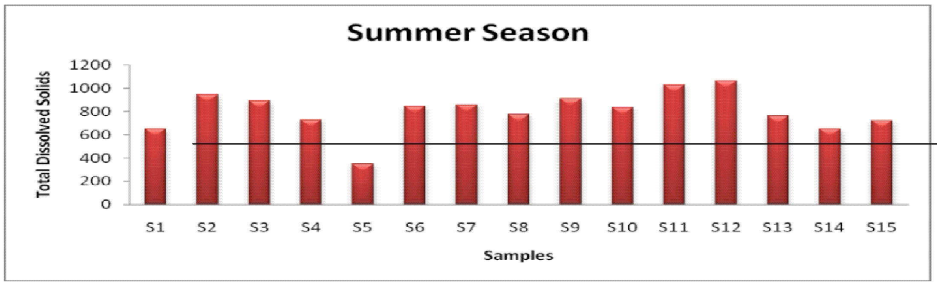

Figure 1: Seasonal Variation in Total Dissolved Solids of open well and bore-well water of First Rainy Season.

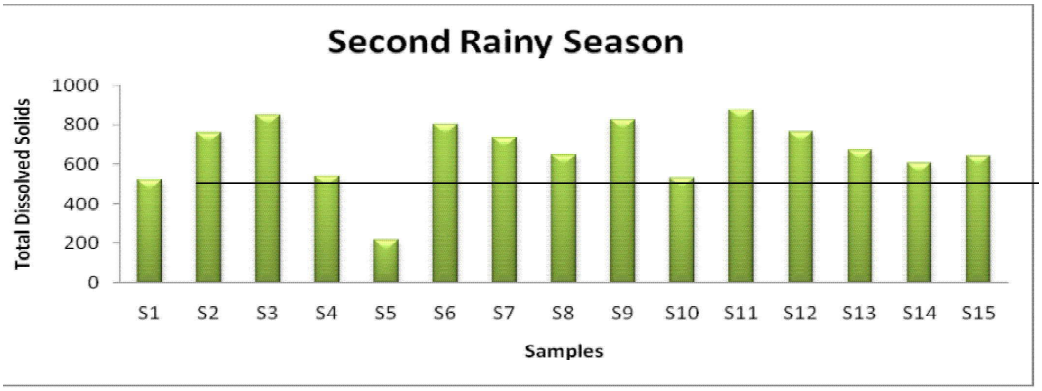

Figure2: Seasonal Variation in Total Dissolved Solids of open well and bore-well water of Summer Season.

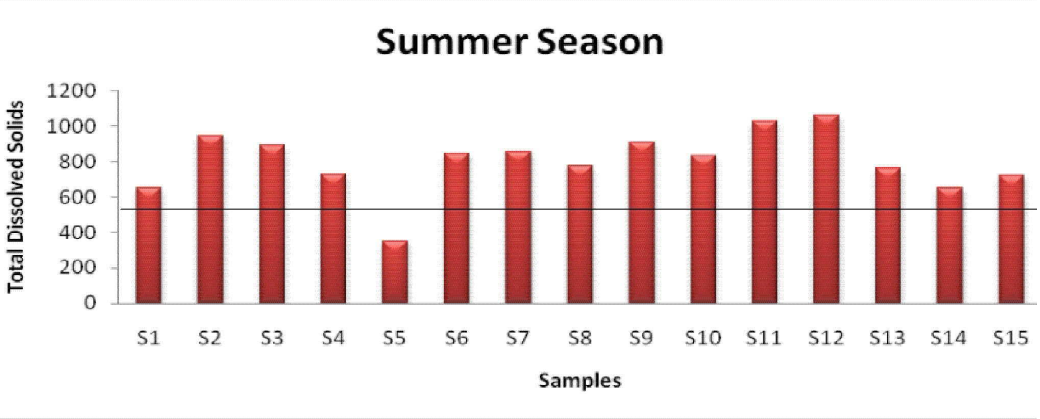

Figure 3: Seasonal Variation in Total Dissolved Solids of open well and bore-well water of Second Rainy

Conclusion :

Ground water samples were collected from the open well and Bore wells located in and around Dhule City to determine their quality and fitness for drinking purposes. Their total hardness, Na^+, K^+ Ca^{++}, Cl contents and pH are within the permissible limits, set by ISI and WHO. However water samples S-3, S-4 and S-5 have inferior potability due to effluents from house hold, industries and sewage. Among these water samples S-4, is highly polluted and unfit for drinking purpose and hence some suggestions are made from our side that there should be proper development of drainage network, conservation of ground water resource by means of executing proper management plan of ground water reservoir and launching of awareness program among the peoples about the health while utilizing such ground water for drinking purpose.

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